

APPENDIX B

FLOW CHARTS OF DATA SET USED IN THE DEVELOPMENT OF CORRELATION EQUATIONS AND EMISSION FACTORS

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In order to apply and use the new emission factors and correlation equations correctly, it is important to understand how they were derived. The following three flow charts are presented below:

Flow chart 1: Development of 1995 EPA Correlation Equations and Factors for the Petroleum Industry summarizes the sequence by which default zero factors, correlation equations, pegged at 10,000 ppmv and pegged at 100,000 ppmv factors, screening value ranges, and average emission factors for the petroleum industry were derived in the 1995 EPA Protocol.

Flow chart 2: Development of Revised 1995 EPA Correlation Equations and Factors for the Petroleum Industry is similar to flow chart 1 except the refineries and marketing terminals bagged data, collected using the blowthrough bagging technique, were adjusted to account for the hydrocarbon leak flowrate.

Flow chart 3: Development of the Oil and Gas Production Correlation Equations and Factors summarizes the sequence by which default zero factors, correlation equations, pegged at 10,000 ppmv factors, screening value ranges, and average emission factors for oil and gas production facilities were derived.

Flow Chart 1 - Development of 1995 EPA Correlation Equations and Factors for the Petroleum Industry:

As shown in flow chart 1, collected 1993 bagged data from refineries, marketing terminals, and oil and gas production facilities were combined to develop default zero factors, correlation equations and pegged factors for the petroleum industry referenced as the Correlation Equation Method. Note that default zero data were not collected from oil and gas production facilities; the default zero factors were based on the refineries and marketing terminals data only.

The Correlation Equation Method was applied to additional screening data from marketing terminals (time period unknown) and from oil and gas production facilities (1993) to develop screening value range emission factors for marketing terminals and production facilities respectively. Note that no additional screening data were collected for refineries during the 1993 Refinery Study. Thus, the refinery screening value range emission factors presented in the 1995 EPA Protocol are based on 1980 and 1982 refining fugitive emission studies. The refinery, marketing terminal, and oil and gas production screening value range emission factors are referenced as the Screening Value Range Method or the Leak/No leak Method.

Additionally, fugitive emissions were combined and averages were determined by service types and component types for marketing terminal and production separately. Again, because no additional screening data from refineries were collected, the refinery average emission factors presented in the 1995 EPA Protocol are based on 1980 and 1982 refining fugitive emission studies. The refinery, marketing terminal, and oil and gas production average emission factors are referenced as the Average Emission Factor Method.

Flow chart 2 - Development of Revised 1995 EPA Correlation Equations and Factors for the Petroleum Industry:

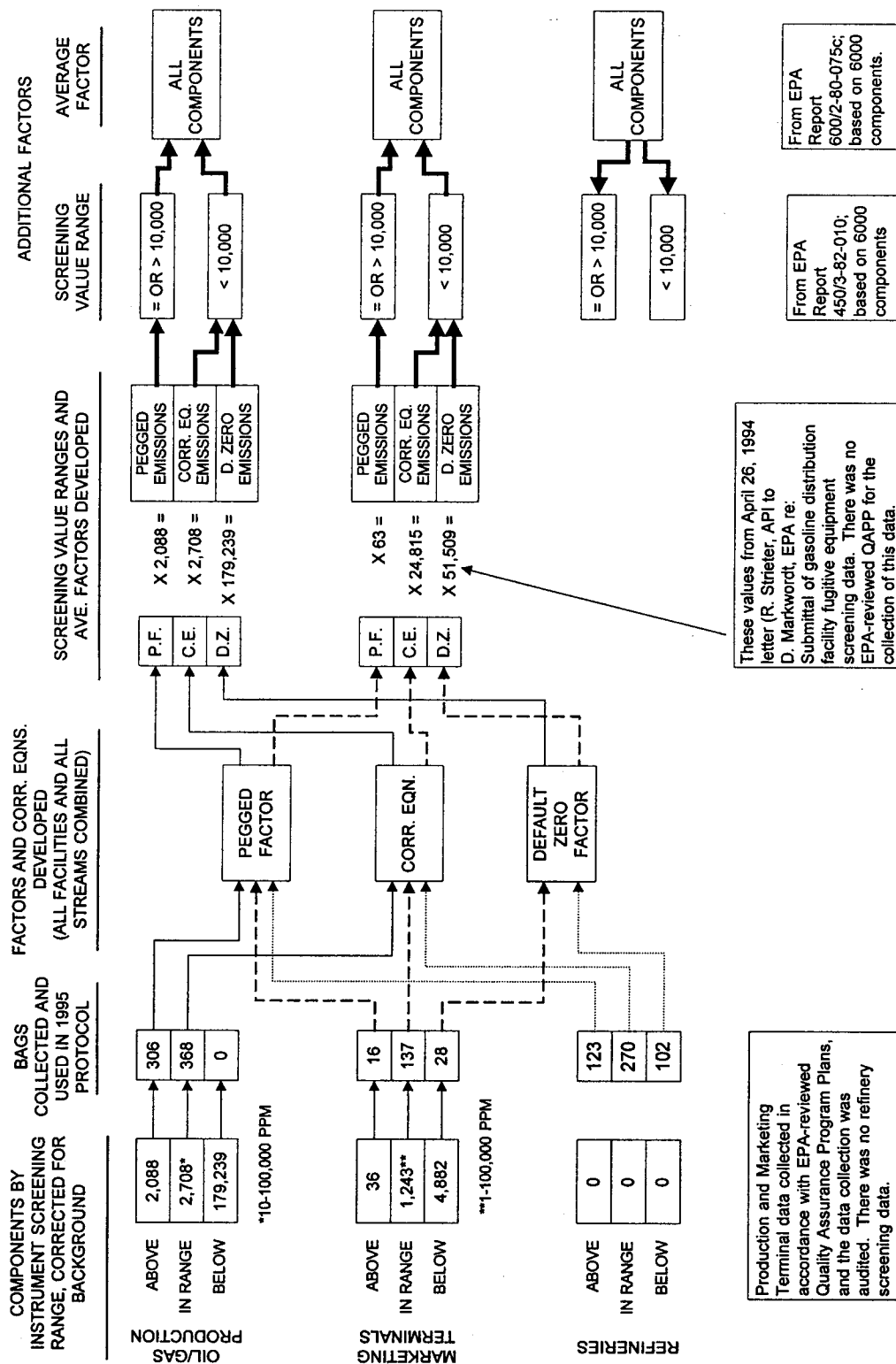
Flow chart 2 is similar to flow chart 1 except the refineries and marketing terminals bagged data, collected using the blowthrough bagging technique, were revised to account for several technical corrections and adjustments. These technical corrections and adjustments include the following: adjustments to account for hydrocarbon leaks in bags collected with the blowthrough method; removal of one set of data from components that were double counted; removal of data from components that exceeded the 1995 EPA Protocol's 5% O₂ concentrations criterion; inclusion of data that had been inadvertently omitted; and, inclusion of data from liquid leaks in additional pegged source calculations. The revisions resulted in changes to average emission factors, screening value range factors, default zero factors, correlation equations, and pegged factors, ranging on the order of a few percent to about 50 percent. At this time, CAPCOA recommends that the default zero factors, correlation equations, and pegged factors be revised to account for the documented technical corrections and adjustments.

Screening value range and average emission factors for oil and gas production were revised based on the separate set of oil and gas production default zero factors, correlation equations, and pegged at 10,000 ppmv factors (see flow chart 3). However, revision to screening value range and average emission factors for marketing terminals were not revised because the revision would require additional subjective review of the marketing terminals data set which is not feasible at this time.

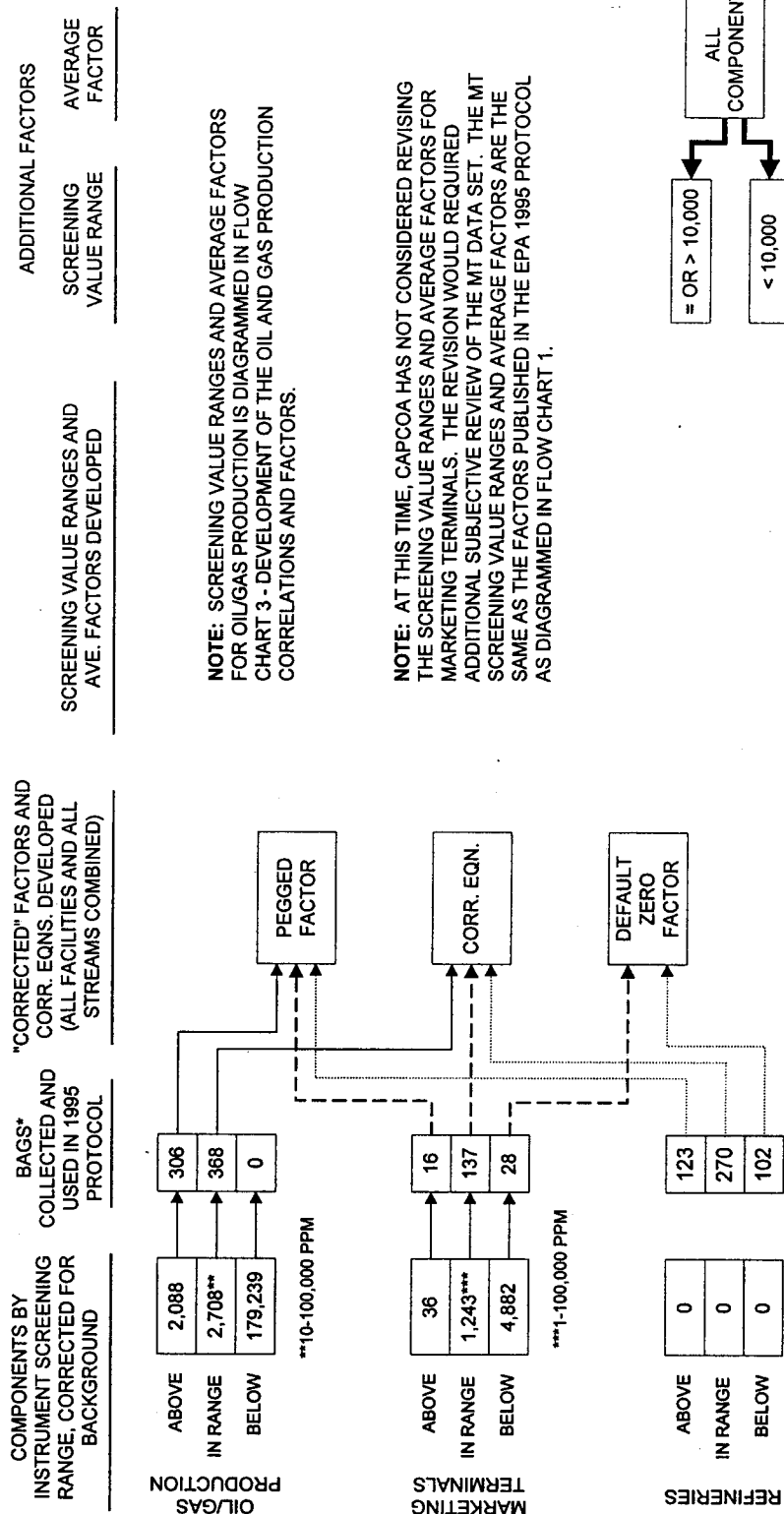
Flow chart 3 - Development of the Oil and Gas Production Correlation Equations and Factors:

Not enough data are available at this time to develop a complete separate set of default zero factors, correlation equations, and pegged factors for oil and gas production operations. As shown in flow chart 3, data were only sufficient to develop pegged factors. The correlation equations were developed using the combined facility types data set (refineries, marketing terminals, oil and gas production). It should also be noted that default zero data were not collected from oil and gas production facilities. Therefore, the correlation equations were used to develop default zero factors using a screening value of 9.9 ppm.

DEVELOPMENT OF EPA 1995 CORRELATION EQUATIONS AND FACTORS FOR THE PETROLEUM INDUSTRY FLOW CHART 1 (SOURCE: SBCAPCD, 1997)



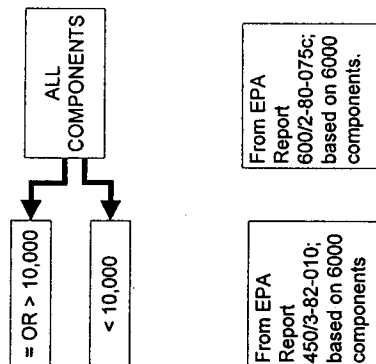
FLOW CHART 2 DEVELOPMENT OF CORRECTED EPA 1995 CORRELATION EQUATIONS AND FACTORS FOR THE PETROLEUM INDUSTRY (SOURCE: SBCAPCD, 1997)



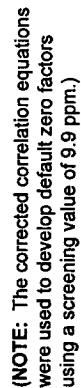
Production and Marketing Terminal data collected in accordance with EPA-reviewed Quality Assurance Program Plans, and the data collection was audited. There was no refinery screening data.

*Bagged data for MT and R corrected for blow-through method.

ARB/SSD, 1997



FLOW CHART 3



*Bagged data for MT and R corrected for blowthrough method.